

## Tessellations

ID: 10251

Time required  
60 minutes

### Activity Overview

*In this activity, students will explore tessellations of triangles and quadrilaterals. They will use the transformation tools of symmetry, reflections, rotations, and/or translations.*

### Topic: Transformational Geometry

- *Create tessellations using reflections, rotations, and/or translations.*

### Teacher Preparation and Notes

- *This activity is designed to be used in a high school or middle school geometry classroom.*
- *This activity is designed to be **student-centered** with the teacher acting as a facilitator while students work cooperatively. Use the following pages as a framework as to how the activity will progress.*
- *This activity requires the use of the Cabri Jr. application. Be sure that it is loaded onto each student's calculator before beginning the activity.*
- *A tessellation is a tiling pattern that covers the plane without any gaps or overlaps. Where the tiling shapes meet (either at vertices or along edges), exactly  $360^\circ$  must be accounted for by the angles of the shapes.*
- **Note:** *Measurements can display 0, 1, or 2 decimal digits. If 0 digits are displayed, the value shown will round from the actual value. To change the number of digits displayed:*
  1. *Move the cursor over the value so it is highlighted.*
  2. *Press  $\boxed{+}$  to display additional decimal digits or  $\boxed{-}$  to hide digits.*
- **To download the Cabri Jr file and student worksheet, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter "10251" in the keyword search box.**

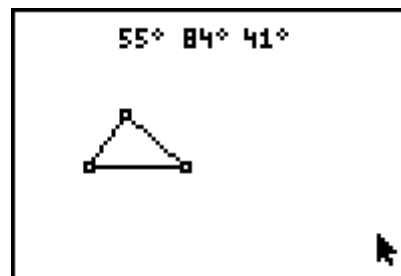
### Associated Materials

- *Tessellations\_Student.doc*
- *RECTNGL.8xv (Cabri Jr. file)*

### Problem 1 – Triangles

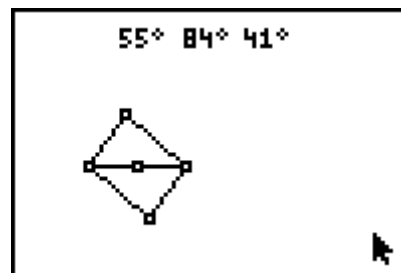
**Step 1:** Open a new *Cabri Jr.* file. Use the **Triangle** tool to construct a *scalene* triangle.

Measure the angles of the triangle using the **Angle** tool.



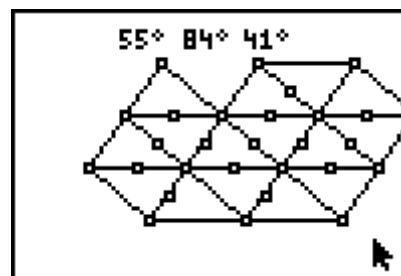
**Step 3:** Construct the midpoint of one side of the triangle using the **Midpoint** tool.

The **Symmetry** tool performs a reflection through a point (which is equivalent to a half-turn or  $180^\circ$  rotation). Use this tool to reflect the triangle through the midpoint.



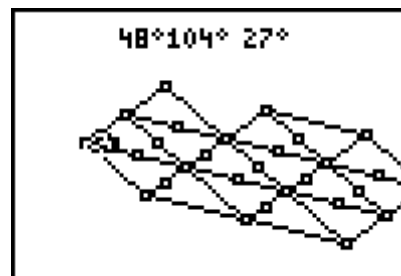
**Step 4:** Continue to make copies of the triangle using the **Midpoint** and **Symmetry** tools. Cover a portion of the screen with the tessellation.

Make a sketch on the worksheet.



**Step 5:** Drag a vertex of the original triangle. Observe the results.

Answer the questions on the worksheet.



**Step 6:** How many angles come together at one vertex of the tessellation?

What are the measures of these angles? Measure them directly using the **Angle** tool or use deductive reasoning to conclude what the measures are based on the Symmetry transformation.

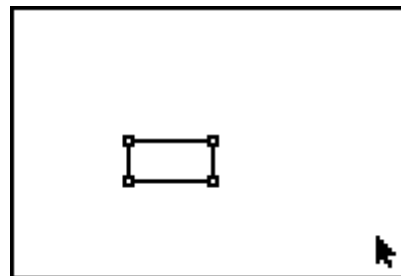
**Step 7:** Find the sum of the measures of these angles. If needed, use the **Calculate** tool.

Drag a vertex of the original triangle and observe the results.

## Problem 2 – Rectangles

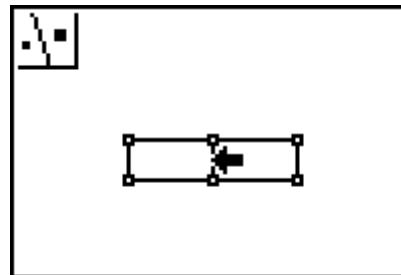
**Step 1:** Open the file *RECTNGL*. Students will be using three different transformation tools to tessellate the rectangle.

After each file is saved with a new name, students may drag a vertex of the rectangle to adjust its dimensions.



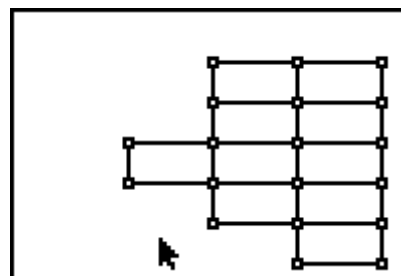
**Step 2:** First, use the **Reflection** tool. Save the file with the name *RECTREFL* so the original file will be available for the next transformation.

To perform the reflection, select the rectangle and a line of reflection. The line of reflection may be a line, a segment, or a side of the rectangle.



**Step 3:** Cover a portion of the screen with copies of the rectangle.

Make a sketch and record observations on the worksheet.



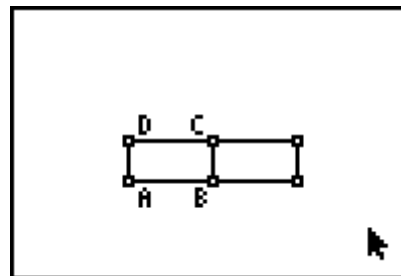
**Step 4:** Now use the **Translation** tool. Open the *RECTNGL* file and save it with the name *RECTTRAN*.

A translation uses a vector, which can be thought of as a “directed” line segment.

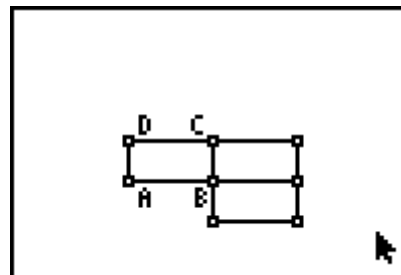
To perform the translation, select the rectangle and the endpoints of a line segment. The order of selection of the endpoints *determines the direction of the translation*.

Use the endpoints of one side of the rectangle for the translation vector.

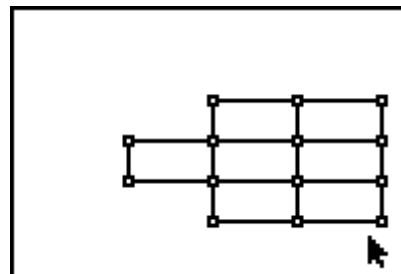
In this figure, points A and B were selected in that order to produce the translation.



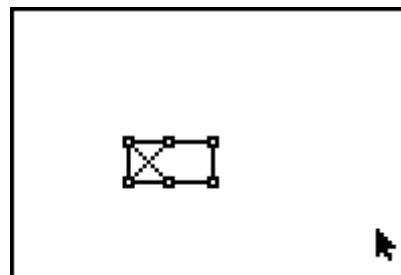
**Step 5:** In this figure, the rectangle on the right side was selected. Then points C and B were selected in that order to produce the translation.



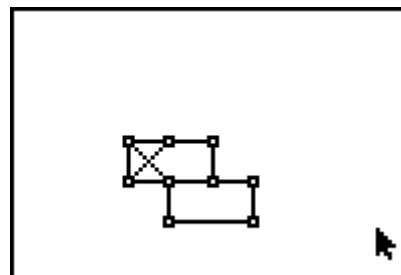
**Step 6:** Cover a portion of the screen with copies of the rectangle.  
Make a sketch and record observations on the worksheet.



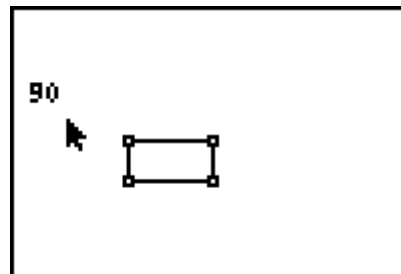
**Step 7:** Next, we will try a different translation. Open the *RECTNGL* file and save it with the name *RECTTRX*.  
Construct the midpoint of each long side of the rectangle. Create two diagonal segments as shown.



**Step 8:** Use the endpoints of one diagonal segment as the translation vector.  
What pattern will result?



**Step 9:** Finally, use the **Rotation** tool. Open the *RECTNGL* file and save it with the name *RECTROT*.  
Use the **Alph-Num** tool to place the number 90 on the screen.

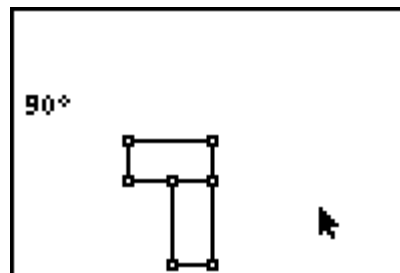


**Note:** Press **[ALPHA]** to access numerical characters. The tool icon in the corner of the screen will display  **$\frac{1}{A}$** .

Press **[ENTER]** to start and end the text.

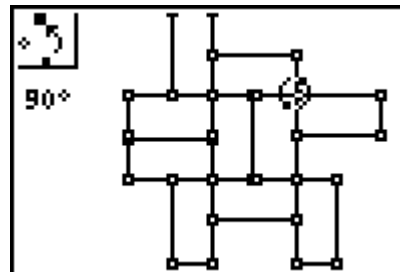
**Step 10:** To perform the rotation, select the rectangle, the number 90, and a point as the center of rotation. Use a vertex of the rectangle for the center of rotation.

The rotation is completed in a *counter-clockwise* direction.



**Step 11:** Cover a portion of the screen with copies of the rectangle.

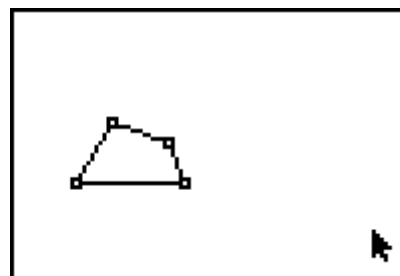
Make a sketch and record observations on the worksheet.



### Problem 3 – Quadrilaterals

**Step 1:** Have students open a new *Cabri Jr.* file.

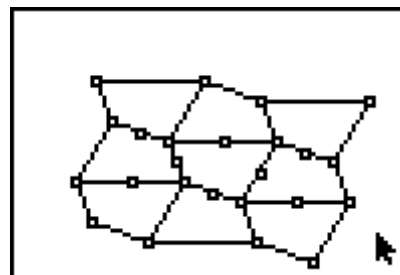
Students are to construct a quadrilateral using the **Quad.** tool.



**Step 2:** Use any of the Transformation tools to create a tessellation with the quadrilateral.

Cover a portion of the screen with copies of the quadrilateral.

Make a sketch and record observations on the worksheet.



**Step 3:** How many angles come together at one vertex of the tessellation?

What are the measures of these angles?

Find the sum of the measures.

**Step 4:** Drag a vertex of the original quadrilateral and observe the results.

